

## Discussion

The USPTO objected to Claims 13 and 24 asserting that each claim contained improper claim language. The applicants have amended those claims to overcome these objections.

The USPTO also rejected Claims 13, 24, 27 and 28 under 35 USC § 112 as being indefinite. In order to overcome this rejection, the applicants have amended Claims 13 and 24 to introduce proper Markush terminology.

The USPTO also rejected all claims of the application under 35 USC § 103 asserting that they were unpatentable over Zimmermann, et. al., U.S. Patent No. 5,378,350, ("Zimmermann") taken together with Kerby, et. al., U.S. Patent No. 5,258,567, ("Kerby"), and in addition, for some of the claims, Hamner, U.S. Patent No. 4,212,771, ("Hamner"). The applicants respectfully traverse each rejection.

The applicants have discovered a new dehydrogenation catalyst, which is particularly useful for vapor phase dehydrogenation. The catalyst comprises chromium oxide on a carrier and at least two promoters, i.e. zirconium and magnesium, and preferably an alkali promoter selected from sodium and potassium. The prior art teaches that an effective dehydrogenation catalyst contains chromium oxide on alumina. The applicants have surprisingly discovered that the performance of this dehydrogenation catalyst can be improved by the addition as promoters of both zirconium and magnesium. The

applicants have surprisingly discovered that there is a symbiotic relationship when both zirconium and magnesium are added to this catalyst as promoters. By adding both magnesium and zirconium as promoters, the resulting catalyst exhibits higher selectivity and higher olefin yield after aging than comparative catalysts that merely contain an alumina carrier, chromium, an alkali metal, and either, but not both of, magnesium or zirconium. (See Table 1, page 20 of the application.) This was a surprising result and is not taught by the prior art.

Zimmermann, et. al.

Zimmermann is the primary reference cited by the United States Patent and Trademark Office. It discloses a conventional dehydrogenation catalyst comprised of an alumina carrier onto which chromia and zirconia have been added. Further, as acknowledged by the Examiner, Zimmermann also requires the addition of "at least one cesium metal compound promoter." The claims of this application, as now filed include "consisting essentially of" language. In a Preliminary Amendment filed with the RCE documents, the applicants argued that cesium had been eliminated as a potential component of the claimed catalyst, thereby eliminating Zimmermann as a reference against the application.

In response to that argument, the USPTO asserted that while Zimmermann disclosed the use of cesium, other alkali or alkaline earth materials could also be suitable promoters. In addition, the

USPTO asserted that "applicants have not shown that the additional material in the catalyst composition of Zimmermann [presumably cesium] materially affects applicants' catalyst composition."

Regardless of whether Zimmermann requires the addition of cesium, the USPTO acknowledged that Zimmermann "does not disclose using the magnesium and alkali metal promoter (sodium or potassium) together, and he does not disclose the magnesium concentration either." (Office Action, page 5, third paragraph.) In order to overcome the clear deficiencies in Zimmermann, the USPTO asserted that it would have been "*prima facie*" obviousness to have added magnesium to the catalyst of Zimmermann based on the teaching of Kerby.

Kerby, et. al.

In order to understand what is (and is not) taught by Kerby, it is necessary to review carefully its disclosures. While Kerby does disclose a dehydrogenation catalyst, its composition is quite different from that of either the application or Zimmermann. The composition of the catalyst of Kerby comprises an active metal selected from the group consisting of Pt, Cr, Pd, Ir, Rd and mixtures thereof, preferably Pt and a modifier metal selected from the group of Sn and Ga. To these active metals may be added a second modifier metal selected from the group consisting of alkali metals, alkaline earth metals and rare earth elements. (The number of elements that are included in this group, i.e. alkali metals,

alkaline earth metals and rare earth elements is 27.) These active ingredients are all deposited on a pillared mica carrier, preferably a pillared tetrasilicic fluoromica carrier.

Accordingly, the composition of the catalyst of Kerby differs significantly from the catalyst of both the application and the catalyst taught by Zimmermann. 1) It utilizes a different catalyst support, i.e. pillared mica. 2) The preferred active catalytic material that is utilized in the examples is platinum, whereas Zimmerman and the application use chromium. 3) Kerby requires a second modifier metal selected from Sn or Ga, neither of which is even mentioned in the application or Zimmermann. 4) Further, its second modifier is selected from 27 different metals, some of which are disclosed in Zimmermann and the application, but most of which are not disclosed. Because of these vast differences in composition, a person skilled in the art would not even review Kerby as the source for a promoter for the catalytic material of Zimmermann.

The principal disclosure for which the USPTO cites Kerby is its "alleged" teaching of the addition of magnesium as a promoter. The cited modifier metals in Kerby from which magnesium is chosen include all alkali metals (Li, Na, K, Rb, Cs and Fr), all alkaline earth metals (Be, Mg, Ca, Sr, Ba and Ra), and all rare earth elements (La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu). There are a total of 27 of these elements. A person

skilled in the art would not be taught to prefer magnesium over the other elements on this list. The choice of one element from a long list of elements to satisfy an obviousness rejection is not permitted under the USPTO rules or case law. For example, in In re: Doumani and Huffman 126 USPQ 408, 410 (CCPA 1960), the Court was faced with a similar situation. The patent that was cited by the USPTO against the patentability of an application listed a wide variety of metals which were suitable for use as a catalyst "with more than thirty metals being specifically named as examples." (126 USPQ at 410). The Court disallowed this obviousness rejection asserting,

Merely because both platinum [the element disclosed in the reference] and rhodium [the element from the application] are included in the list does not, in our opinion, necessarily establish any close relationship between them, or indicate a likelihood that they would be generally equivalent as catalysts.

Using the same type of analysis of the disclosure of Kerby and the claimed invention, it is necessary to determine whether a person skilled in the art would have obviously chosen magnesium from the long list of acceptable elements in Kerby to add to the applicants' composition that already contained chromium, zirconium and preferably an alkali metal. Kerby does not provide any incentive for a person skilled in the art to chose magnesium over any of the other 26 elements that are present in this long list of possible elements. This is especially true as the modifier element of Kerby at issue is intended to modify the performance of active metals

(Pt, Sn or Ga) which are entirely different from the active metals of either Zimmermann (Cr) or the application (Cr). Accordingly, the applicants respectfully assert that Kerby provides no motivation or suggestion for a person skilled in the art to chose magnesium as the active component to add to the composition of the application.

While obviousness does not require proof of absolute predictability, at least some degree of predictability is required. (MPEP 2143.02) Proof that one out of 27 elements that might be useful for a catalyst with a composition (Kerby) that is entirely different from the catalyst of the primary reference (Zimmermann), does not establish a reasonable expectation that the same component may be useful in the catalyst of the invention.

#### Analysis of Prima Facie Obviousness

The USPTO has established a three step test to prove *prima facie* obviousness. The first step requires the Examiner to set forth the differences in the claims over the cited reference or references and to explain the suggestion or motivation in the reference or references which would encourage a person skilled in the art to modify the reference to overcome these differences. The primary difference between the claims of the application and disclosure of Zimmermann is that the catalyst of the application requires the presence of both zirconium and magnesium as promoters, while Zimmermann only teaches the addition of zirconium. The issue is therefore whether a person skilled in the art would modify

Zimmermann to add magnesium, based on the teachings of Kerby. The applicants respectfully assert that there is no motivation because Kerby teaches that any one of 27 different metals could be used as a promoter for the catalyst of Kerby. The vast number of optional components eliminates any finding of obviousness. In addition, the composition of the catalyst of Kerby differs substantially from that of the catalyst of Zimmermann. Accordingly, the applicants respectfully assert that this first step to prove *prima facie* obviousness has not been satisfied.

The second step requires the USPTO to prove that the proposed modification of the references would be likely to arrive at the claimed subject matter. It is unclear from the disclosure of Kerby what modifications should be made to the catalyst of Zimmermann based on the teachings of Kerby. For example, Kerby teaches that the preferred carrier material that should be used is pillared mica, yet pillared mica is not used in Zimmermann. Further, Kerby teaches that the preferred active catalyst is Pt, yet Zimmermann uses Cr. In addition, Kerby requires the addition of a second modifier selected from Sn and Ga, neither of which is discussed or suggested by Zimmermann. Thus, a person skilled in the art would find it difficult to even determine what proposed modification or modifications should be made to the catalyst of Zimmermann based on the teachings of Kerby.

Finally, the third step to establish *prima facie* obviousness

requires the USPTO to explain why the proposed modification would be obvious. Thus, the USPTO must establish that a person skilled in the art would chose magnesium from the list of 27 elements and add it to the composition of Zimmerman, and yet not change the composition of the carrier to pillared mica, nor change the active metal Cr to Pt, nor add Sn or Ga as a modifier. The applicants respectfully assert that there is not sufficient teaching in Kerby to arrive at the composition of the application.

**Hamner**

The teaching of Hamner does not add to the teaching of Zimmermann and Kerby as Hamner was cited by the USPTO only to disclose that a calcined alumina should be used as a carrier. Hamner does not teach nor suggest the addition of magnesium to a catalyst. Accordingly, it is not helpful in teaching the composition, as claimed.

**CONCLUSION**

The applicants respectfully assert that the invention, as claimed, is not taught by the references cited and request the issuance of a Notice of Allowance. If there are any questions concerning this matter, please contact applicants' counsel.

Respectfully submitted,



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